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THE B-52 CAN IT FLY UNTIL 2050?

BY

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Major Peter D. Axelson enlisted in the Air Force in 1976 and upon completion of technical training was a missile systems analyst on the B-52 Short-Range Attack Missile System and Quality Assurance Inspector. After earning a Baccalaureate Degree in Industrial Technology from the University of Maine and an Associate Degree in Electronics from the Community College of the Air Force, Major Axelson received his commission from Officer's Training School in 1986. Since graduating from Munitions Officer School in 1986, Major Axelson has served in various munitions, aircraft maintenance and transportation functions at Squadron and Command level. He has a master's degree in Economics from the University of Oklahoma, and a master's degree in Airpower Art and Science from the School of Advanced Airpower Studies. In July 2000, Major Axelson was appointed commander of the 2d Munitions Squadron.

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ABSTRACT

A recent Department of Defense program initiative would keep the B-52H Bomber flying until the year 2050. This proposal, which extends the life of the B-52H for an unprecedented 90-year term is understandable in light of current Department of Defense budget constraints, but questions of effectiveness and feasibility remain. The bottom-line question is, "Can the B-52H survive as an adequate strategic bomber until the projected 2050 phase out?" With the next generation bomber not scheduled to be fully mission-capable until 2037, it is critical that the existing data be examined to determine the feasibility of the current projection. This paper builds a foundation by highlighting the extensive B-52H history of aircraft modifications and mission changes. These significant modifications to the B-52H provided additional capabilities, which are key factors in the B-52H's ability to survive in today's strategic environment. The second major section addresses the possibility of modifying or extending the life of the B-52H airframe, and the effectiveness of such a weapon system in the future strategic environment. This section is subdivided into three areas. The first area will analyze data concerned with B-52H structural integrity. The focus of the second area of analysis is the acquisition of spare parts. The third and final area of analysis is the level of survivability the B-52 H has against current and future threats. The third and final section of this paper concerns the conclusions and implications resulting from the historical evidence and analysis presented in sections one and two. In addition, implications from this study are presented in an effort to provide the reader with informed speculations as to what the previous research implies.

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Introduction

A recent Department of Defense program initiative would keep the B-52H Bomber flying until the year 2050. This proposal, which extends the life of the B-52H for an unprecedented 90-year term is understandable in light of current Department of Defense budget constraints, but questions of effectiveness and feasibility remain. The bottom-line question is, “Can the B-52H survive as an effective strategic bomber until the projected 2050 phase out?”

If the claims and projections have foundation, the B-52H airframe may provide maximum punch for United States defense dollars. If, on the other hand, these projections are unfounded, there will be a number of problems associated with the corresponding shortfall in military effectiveness. With the next generation bomber not scheduled to be fully mission-capable until 2037, it is critical that the existing data be examined to determine the feasibility of the current projection.

To answer the question above, this paper is divided into three major sections that address two central sub-questions. The first of these is, "Can the B-52H fly until the final airframe is phased out in 2050?" The second sub-question is, "Can the B-52H remain effective until the scheduled phase out?"

The first section will build a foundation by highlighting the extensive history of aircraft modifications and mission changes for the B-52H. This section will identify, in a chronological format, the origins of the B-52H model, what modifications have been

made to the B-52H and how these modifications factor in the B-52H model's mission evolution. We'll look at how these significant modifications to the B-52H provided additional capabilities, which are key factors in the B-52H's ability to survive in today's strategic environment.

The second major section addresses the possibility of modifying or extending the life of the B-52H airframe, and the effectiveness of such a weapon system in the future strategic environment. This section is subdivided into three areas. The first area will analyze data concerned with B-52H structural integrity. We will review B-52H service life data as it pertains to the Air Force structural integrity program, identifying current and future plans for structural modernization of the B-52H. The focus of the second area of analysis is the acquisition of spare parts. Currently there is much speculation pertaining to research data for spare parts for the B-52H. This paper will address parts acquisition and serviceability. Discussion will pertain to the limited supply and condition of numerous spares from the B-52 "bone-yard" and current "mom and pop vendors" in an attempt to determine if the Air Force will be able to source these parts once stock levels are exhausted during the next few years. The third and final area of analysis is the level of survivability the B-52H has against current and future threats. The purpose of this area is not to provide an "electronic warfare road map" to be used as a planning tool for future acquisition. Rather, this section provides a general discussion of current and projected capabilities and compares them to the best estimates of future threats available at the unclassified level.

The third and final section of this paper concerns the conclusions and implications resulting from the historical evidence and analysis presented in sections one and two. In

addition, implications from this study are presented in an effort to provide the reader with informed speculations as to what the previous research implies.

Chapter 1

A Brief History of the B-52H

The venerable B-52 is a classic example of the versatility and adaptability of a large, long-range manned aircraft. It is a tribute to American technology and doctrinal flexibility.

General G. Lee Butler

Introduction

The first flight of the B-52H was on 20 July 1960, although full production of the 102 H-models didn't begin until 1961. On 9 May 1961, the first B-52Hs were delivered to operational flying units. On 26 October 1962, the final B-52H was delivered, ending production of the B-52 Stratofortress at Boeing's Wichita, Kansas location.[1] The B-52H was the last version of the Stratofortress produced and is the only version remaining in service, with all other models either in storage or scrapped.[2] Throughout the Cold War the B-52 was given a nuclear mission, able to drop gravity or unguided nuclear weapons, as well as Short-Range Attack Missiles and Air-Launched Cruise Missiles. By the end of 1994, three of the remaining five B-52H units were deactivated and the entire fleet was consolidated at two locations. Minot Air Force Base in North Dakota and Barksdale Air Force Base in Louisiana were the only remaining locations to have the B-52H, with a

Notes

[1] Joe Baugher, Boeing B-52 Stratofortress [article online], accessed on 1 December 1999; available from http://www.csd.uwo.ca/~pettypi/elevon/baugher_us/b052-22.html. Chapter 23, Page 1.
[2] Ibid., Chapter 22, page 1.

total of 94 aircraft in service.[3] Spending most of their service life on nuclear alert missions, B-52Hs saw their first combat missions in Desert Strike in 1996 (B-52Gs flew Desert Storm strike missions during the Gulf War). In January 1999, flying out of Diego Garcia, the B-52Hs dropped over 90 Air-Launched Cruise Missiles on Iraq during Operation Desert Fox,.[4] Several months later, B-52Hs bombed targets in Yugoslavia as part of Operation Allied Force.[5]

Modification History

Although the B-52 was designed primarily for high-altitude intercontinental bombardment missions, it has served effectively in low-altitude roles. The B-52H was originally intended for low altitude missions and extensively modified to perform that role. In addition to numerous mission changes throughout the last four decades, the B-52 witnessed a multitude of innovative modifications to its airframe. The most visible difference between the H-models and other versions are the TF-33 engines that replaced the J-57 water-injected turbo jet engines. Although Pratt and Whitney manufactured both engines, the TF-33 engines provided approximately 30 percent more thrust than their water-injected predecessors. More than 17,000 pounds of thrust could be delivered, providing improved performance and decreasing the take-off roll requirement by 500 feet, providing an additional degree of safety during take-off.[6] In addition, the TF-33 was more economical, providing a marked improvement in range. The B-52H has a combat radius of over 4,100 miles, while carrying a 10,000-pound load of bombs; an improvement over the B-52G, which could only travel 3,550 miles with a similar

Notes

[3] Ibid., 2.
[4] William Garvey, "New Life for Buff," Popular Mechanics, March 1999, 3.
[5] Bruce Rolfsen, "The B-52: Can this Bird Really Fly 90 Years?," Air Force Times, 11 October 1999, 15.

weapons configuration.[7] Another change worthy of note was the replacement of the four half-inch machine guns carried on previous versions with a single General Electric M61A1 20-millimeter cannon in the tail.

In contrast to the original high-altitude B-52 mission of earlier models, the H-model was equipped to make low altitude operations easier and safer for the crews. This change was consistent with new mission requirements for low-altitude penetrations of Soviet air defenses. Terrain following instrumentation was added, which included an advanced capability radar that provided three-dimensional information on the pilot and navigator video displays. The terrain height was displayed continuously at selected distances in front of the aircraft.[8] Beginning in 1972, the H-models were given an AN/ASQ-151 Advanced Electro-Optical Viewing System, which provided the crew improved low-level night vision. The system is composed of a steerable Westinghouse AN/AVQ-22 low-light level television (TV) camera and a Hughes AN/AAQ-6 Forward Looking Infrared Sensor (FLIR).[9]

> Data that can be presented on these screens includes overlaid terrain avoidance profile trace in both TV or FLIR mode, alphanumeric symbology which includes a height reading from the radar altimeter and time-to-go before weapons release, as well as indicated airspeed, heading error and bank steering, artificial horizon overlay and attitude and position of the sensor in use.[10]

In addition to electronic enhancements, several improvements shortened takeoff time and increased startup reliability. Starter cartridges were installed on every B-52 beginning in January 1963, providing faster engine starts, allowing the B-52 to get

Notes

[6] Baugher, chapter 22, page 1.
[7] Ibid., 2.
[8] Ibid.
[9] Ibid., 9.
[10] Ibid., 9.

airborne quicker, as well as, allowing them to launch from airfields that lacked either electric power or ground support equipment.[11] In 1974, project "Quick Start" provided each engine on the B-52G and H with a starter cartridge. This allowed each engine to ignite simultaneously and resulted in an even quicker take-off.[12]

Several enhancements improved offensive capability and defensive counter-measures. Project "Rivet Ace", which started in 1971, upgraded the electronic counter-measure capability of the H-model with the Phase VI electronic counter measure defensive avionics system.[13] In the early 1980s, the AN/ASQ-176 Offensive Avionics System was installed, replacing the aging and problematic AN/ASQ-38 bombing/navigation equipment. This system was more reliable than its predecessor and was designed specifically for low-level use and was electromagnetic-pulse hardened.[14] Beginning in 1985, H-models began receiving the Norden AN/APQ-156 Strategic Radar, incorporating synthetic aperture technology in place of the ASQ-176s.[15]

Numerous conventional enhancements increased the B-52's weapon and navigational systems capabilities. In 1990, the B-52H was outfitted with the Advanced Cruise Missile, carrying a maximum of 20 per upload. In October 1991, the crew was reduced to five when the gunner station and the M61A1 Vulcan 20-millimeter cannon were removed.[16] In 1994, the H-model began receiving the Conventional Enhancement Modification Program. This program was designed to provide the H-model with an unheralded conventional warfare capability. This program included the addition of the

Notes

[11] Ibid.
[12] Ibid., 5.
[13] Ibid., 10.
[14] Ibid., 11.
[15] Ibid.
[16] Ibid.

AGM-142A and Harpoon system using the heavy storage adapter beam fitted to the underwing pylon.[17] The Harpoon is an anti-ship missile with Inertial Navigation and radar guidance.[18] Additionally, Global Positioning System navigation, AN/ARC-210 VHF/UHF radio with secure voice encryption and the military standard 1760 databus were added to provide the H-model with the capability to interface with a new generation of munitions. These munitions included the Joint Standoff Weapon, Joint Direct Attack Munitions and the Wind Corrected Munitions Dispenser.[19]

Weapons Configurations

A review of the various armament configurations available on the B-52H indicates the large amount of flexibility in the weapon system. The B-52H carries approximately 70,000 pounds of mixed ordnance, combining bombs, mines and missiles. The B-52H bomb bay is 28 feet long and six feet wide. The H-model can carry three nine-bomb clips or two four-bomb clips in its bomb bay.

> Conventional internal B-52 loads include 27 each of SUU-38H/B (CBU-52, -58 and –71), Mark 82 500-pound conventional or Snake Eye bombs, Mark 36 500-pound Destructor bombs, Mark 59 or 62 500-pound Quickstrike mines or Mark 117 750-pound bombs (conical fin, Destructor, retarded or air-inflatable retard); 18 each of MJU-1B countermeasures sets or M129 leaflet dispensers; 12 each of Mark 52 2000-pound mines; six each of CBU-87 combined effects munitions or CBU-89 Gator. Alternatively, a clip of 8 Mark 84 2000-pound bombs, Mark 41 2000-pound Destructors, Mark 55 2000-pound bottom mines, Mark 56 2000-pound moored magnetic mines, Mark 60 2360-pound captive torpedoes (CapTor), Mark 64 or 65 2000-pound Quickstrike mines, or AGM-86C cruise missiles can be carried inside the bomb bay.[20]

Either of two types of external pylons can be loaded under the wings of the B-52H. The longer version is capable of carrying a maximum of six Air Launched Cruise

Notes

[17] Ibid., 12.
[18] Garvey, 4.

Missiles or Advanced Cruise Missiles per pylon. The shorter underwing pylon, not compatible with either cruise missile, can carry a maximum of 12 conventional bombs.

The B-52H also received the AGM-69A Short-Range Attack Missile and the AGM-86 Air Launched Cruise Missile. This enabled the H-model to carry 12 Air Launched Cruise Missiles under wing, six on each pylon. Another weapon carried by the H-model is the AGM-129A Advanced Cruise Missile. Twelve Advanced Cruise Missiles can be carried on the underwing pylons. The development of the Common Strategic Rotary Launcher allowed the H-model to carry 8 Air Launched Cruise Missiles internally, which enabled the B-52H to carry a total of twenty Air Launched Cruise Missiles.[21]

Current Capabilities

An examination of the B-52H bomber's current capabilities highlights its versatility. In its conventional role, the B-52 can perform defensive counter-air, maritime operations, and air-interdiction. It appears to be quite effective when used for surveillance over water and can assist the Navy with mine laying and anti-ship operations. A B-52, in a two-hour period, can provide monitoring of over 70,000 square miles of ocean surface.[22] "All B-52s are equipped with an electro-optical viewing system that uses platinum silicide forward-looking infrared and high resolution low-light-level television sensors to augment the targeting, battle assessment, flight safety and terrain avoidance system, thus further improving its combat ability and low-level flight capability."[23] In addition, B-52 crews wear night vision goggles to provide enhanced night visual low-level terrain

Notes

[19] Baugher, chapter 22, page 12.
[20] Ibid., 5.
[21] Ibid., 7.
[22] B-52 Stratofortress Fact Sheet [data online], ed. Air combat Command Office of Public Affairs, accessed 1 December 1999;available from http://www.af.mil/news/factsheets/B_52_Stratofortress.html. 2.
[23]Ibid. 2.

avoidance operations. Since 1989, a Global Positioning System, heavy stores adapter beams for carrying 1,000 pound munitions and smart weapons capability have made significant contributions to the B-52's ability to carry out its missions. Furthermore, the B-52's aerial refueling capability provides the B-52 with a range, which is limited only by its flight crew. The unrefueled combat range alone is in excess of 8,200 miles.

Future Insight

The Air Force is also considering the addition of a third electronic counter measure system, the replacement of the Inertial Navigation System and Low-Light Television Cameras with newer more reliable versions, and a rework of the cockpit lighting system to provide a better environment for night goggle usage.[24] As a final note, the Pentagon is considering using electronic warfare equipped B-52s as a partial replacement for the EA-6B Prowler jamming aircraft.[25]

Summary

Throughout the last four decades, the B-52 has proven itself to be versatile and adaptable. Through numerous modifications, the B-52H has displayed a level of flexibility rarely seen throughout the history of airpower. Its various armament configurations shape the B-52H's ability to fulfill a multitude of missions. By examining this bomber's current capabilities and reviewing its possible future roles, it has again highlighted the B-52H's versatility. After reviewing the B-52H's extensive history of

Notes

[24] Garvey, 4.
[25] Frank Wolfe, "Pentagon to Weigh bomber Option for Replacement Jammer," Defense Daily, 16 November 1999, 1.

aircraft modifications and mission changes, the logical next step will be to review the current concerns surrounding the dramatic extension to its service life.

Chapter 2

ANALYZING THE CURRENT CONCERNS

Proposal is circulating around USAF Headquarters to eliminate all but a small part of the Boeing B-52 Program.

Aviation Week, 5 January 1953

Introduction

There is no disputing the B-52 bomber's distinguished record of service in support of the military instrument of power. Its versatility and effectiveness are probably second to none when stacked against the performance of the many bombers used throughout the demanding military history of the United States. The purpose of this chapter is not to be an all-inclusive analysis, but an opportunity to review and analyze three of the major areas of contention, related to extending B-52 service life. Sections one and two relate directly to the first sub-question discussed in the introduction, "Can the B-52 fly until the final airframe is phased out in 2050?" The third section discusses an area directly linked to the second sub-question identified in the introduction, "Can the B-52 remain effective until the scheduled phase out?" The first area analyzes data concerned with B-52H structural integrity and reviews service life data as it pertains to the Air Force structural integrity program, identifying current and future plans for structural modernization of the B-52H. The second area of analysis addresses acquisition of spare parts. This chapter

will address parts acquisition and serviceability. The third and final area of analysis concerns the level of survivability the B-52 H will be able to maintain in the coming years against current and future threats.

Structural Integrity

Attempting to determine whether the 40-year old B-52H bombers will wear out before the programmed phase-out is not an easy task. The unusually high number of changes to B-52H mission profiles, munitions carriage, as well as normal flight stresses throughout the years have driven the United States Air Force to rely on the B-52 Structural Integrity Program Master Plan. Although there was not an initial requirement, the B-52 fleet represented one of the first attempts by the Air Force to have a complete Aircraft Structural Integrity Program. A sustained effort has been underway since the late 1950s to implement and continue this program.[26] The B-52 aircraft Structural Integrity Program uses a damage tolerance approach that requires the structure to meet or exceed design load limit capability without major failure.[27] This plan captures the past, current and future structural plans for all B-52 models.

> Design service life criteria were not originally specified for the B-52 but documents cite 5,000 flight hours of typical Strategic Air Command (SAC) usage with a confidence factor of 2.0 implied. A confidence factor, sometimes called a scatter factor, of 2.0 indicates that the design life objective is two times the desired operational life. If it is desired to have a specific operational life with high confidence that there will be no life limiting fatigue cracks, it is necessary to set a design life objective that is higher than the desired operational life. Later requirements called for a minimum confidence factor of 4.0 for modified structure.[28]

Notes

[26]Al Clark and Bill Van Sickle, "B-52 Aircraft Structural Integrity Program (ASIP) Master Plan," OC-ALC/LHRH and Boeing Military Airplane Company – Military Programs - Wichita Division, [CD-ROM], January 1999, 2.1.1.
[27]Ibid, 1.2.
[28] Ibid, 2.1.1.

Now that we have briefly described the Air Force Structural Integrity Program as it pertains to the B-52 fleet, let's review some of the B-52 structural integrity concerns. Over the past four decades the B-52H has undergone a multitude of structural modifications. Most of the structural modifications were a result of stress factors realized in current and future flight profiles and weight considerations due to other modifications.

Current concerns related to structural integrity of the B-52H as of late 1998 were mostly concerned with cracks in one form or another due to in-flight stresses related to the carriage of heavy conventional weapons systems. The first discrepancy concerns fatigue cracking in the 694 bulkhead (partition).[29] This will require some of the B-52H fleet to have bulkhead cord replacement.[30] The second area of concern pertains to multi-site cracking in section 47 skins (outer shell).[31] Currently this section is being inspected and repaired during depot maintenance and the skins may actually require replacement some time in the future.[32] The third problem concerns fatigue cracking in the flaptracks (guides the flap linkage).[33] In order to combat this fatigue cracking, the Air Force has created a comprehensive decision matrix to aid in their disposition.[34] The fourth area of concern pertains to mid-body side skin cracks.[35] Presently the Air Force is determining the cause and formulating a solution to this problem. The fifth problem pertains to upper-wing skin span wise splice cracks.[36] This area receives eddy current inspection during depot maintenance and methods have been developed to repair identified damage.[37] The

Notes

[29] Ibid, 2.3.2.
[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Ibid.
[34] Ibid.
[35] Ibid.
[36] Ibid.
[37] Ibid.

last current structural problem concerns stress corrosion cracks on the engine strut attachment fittings.[38] The Air Force is replacing these fittings with new ones, machined from stress corrosion resistant material.[39]

When discussing future concerns pertaining to the structural integrity of the B-52H fleet, one can only speculate on the number of future structural problems that remain unidentified. Although the majority of current B-52H missions are stand-off in nature, generating less airframe stress than low-level profiles, the Air Force's drawdown of forward basing drives a major increase in the B-52H average sortie duration, which accelerates wear and tear on the airframes. To improve structural analysis in these new missions, the Air Force has identified an important new requirement. The installation of a standard Flight Data Recorder System would improve data quality needed to identify changes in the operating environment, which might significantly alter the structural life of the B-52H.[40] "The current outdated MXU 553 recorder system is difficult to maintain and the percentage of usable data retrieval is very low. In addition the processing and analysis of this poor quality data is very costly and often questionable."[41]

The Air Force appears to be taking full advantage of life cycle wear and tear information available from previous B-52 models to better maintain the B-52H fleet. The aircraft structural integrity program manager, working with Boeing engineering, are tearing down B-52G model aircraft retired at the Aerospace Maintenance and Regeneration Center (AMARC) located at Davis-Monthan Air Force Base.[42] The aircraft are then analyzed for fatigue and corrosion to give valuable data in maintaining the

Notes

[38] Ibid.
[39] Ibid.
[40] Ibid, 2.3.3.
[41] Ibid.

current B-52 inventory. This process has been in work for several years and has born significant fruit.[43]

After reviewing the structural problems identified for the B-52H fleet, the question still remains, "When will these older bombers wear out?" During the period of 1978-1980 a Durability and Damage Tolerance Assessment was conducted on the B-52G/H aircraft structure to determine the lower bound structural life to see how cost effective and viable future modifications might be.[44]

> The economic life is defined as that time when cracking becomes so extensive that it is judged to be more economical to replace the airframe or major components of the airframe than to continue inspections and repair. The lower bound structural life is a conservative (worst case) estimate of the actual economic life. The results of this study indicate that the lower bound structural life of the B-52H structure is to calendar year 2030 with the planned baseline operational usage including tactical maneuver usage.[45]

In addition, the B-52H Durability and Damage Tolerance Assessment has been recently updated. This update incorporates the effects of tactical maneuver and extended usage up through calendar year 2030.[46] "Eighty-two (82) details screened from the two hundred, ninety-two details in the original Durability and Damage Tolerance Assessment were re-evaluated during the update. Of these, an additional twelve (12) details were identified as requiring inspection prior to 2030."[47] Air Force Logistics Command has studied economical modifications and repairs and recommended modifications for those areas where economic concerns dictate.[48] This information combined with safety,

Notes

[42] Ibid.
[43] Ibid.
[44] Ibid, 3.2.6.1.
[45] Ibid.
[46] Ibid, 3.2.6.2.
[47] Ibid.
[48] Ibid, 3.4.

inspection and repair data, was used to build a cost-effective structural maintenance plan that would assure safe operations throughout the extended life of the B-52H aircraft.[49]

Thus far the continued management of the B-52 Structural Integrity Program and the addition of a standard Flight Data Recorder appear to be the necessary insurance the Air Force needs to be able to fly the B-52H until 2030, utilizing the Durability and Damage Tolerance Assessment's "worst case scenario." In addition, according to the "U.S. Air Force White Paper on Long Range Bombers," dated March 1, 1999, the limiting factor of the B-52H's operational life is directly related to the economic limit of the upper wing surface.[50] This limit is calculated to be between 32,500 and 37,500 flying hours.[51] "Based on the projected economic service life and forecast mishap rates, we will be unable to maintain our requirement of 62 aircraft by 2044, after 84 years in service."[52] The Durability and Damage Tolerance Assessment estimates and upper wing surface issue suggests continued flight until 2030 and beyond, but fails to address with any certainty this paper's first sub-question, related to the B-52H's ability to fly until the final airframe is phased out in 2050.

Spare Parts

This second area of analysis is primarily concerned with the acquisition of spare parts for the B-52H. As discussed in the introduction, there appears to be much speculation pertaining to the availability of serviceable spare parts for this bomber fleet. Given that the B-52H was built in the early 1960s it is only logical that a majority of the parts manufacturers have gone out of business, original engineers have retired and the machine tools are no longer serviceable.[53] In light of these realities, the Air Force resorts to removing parts from older B-52s sent to AMARC, a finite parts supply with an

Notes

[49] Ibid.
[50] U.S. Air Force White Paper on Long Range Bombers, March 1999, 21.
[51] Ibid.
[52] Ibid.
[53] Sydney J. Freedberg Jr., "The Military Scrapes for Spares," National Journal, (December 11, 1999): 2.

uncertain life span. "Such salvaged spares can be in bad shape and take weeks or even months to arrive; paying private industry to reconstruct parts from old plans can take even longer and cost more."[54] This problem was also highlighted during the B-52 Weapons System Review conducted in April 1999. During the conference, it was noted that the B-52H still relied on the AMARC as a source of repair parts.[55] Air Combat Command had experienced problems receiving serviceable parts from that same location.[56] The short-term fix was to get numerous duplicate parts removed from the AMARC in order to get a single serviceable part.[57] To make matters worse, Air Combat Command ended up paying for every part that was pulled regardless of final serviceability.[58] Although this problem could have a long-term impact on the mission capable rate of the B-52H fleet, the Air Force is investigating the feasibility of inspecting parts removed from the AMARC prior to receipt by field units.[59] Additionally, the Air Force is investigating the possibility of a depot maintenance facility performing the inspections.[60]

A by-product of parts delays and the receipt of unserviceable parts is an increase in the cannibalization rate. In an effort to maintain as many serviceable aircraft as possible, senior maintenance personnel often require that serviceable parts be removed from aircraft that are awaiting other parts from the supply system and be installed on another aircraft requiring that part. This process allows the one aircraft to be fully mission capable, thereby improving the fully mission capable rate for the base, as well as,

Notes

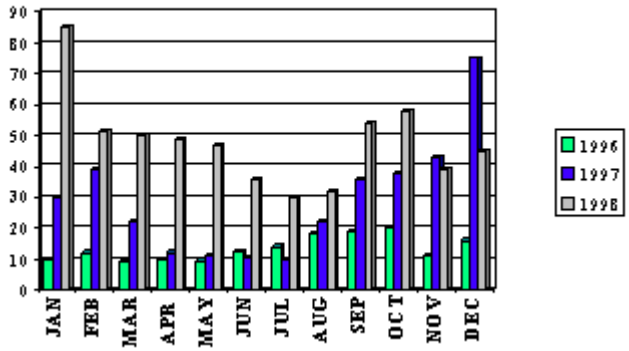
[54] Ibid.
[55] Minutes of the B-52 Weapon System Review, 6-7 April 1999, 4.
[56] Ibid.
[57] Ibid.
[58] Ibid.
[59] Ibid.
[60] Ibid.

providing the United States with a greater number of serviceable aircraft to meet mission requirements. One of the problems associated with cannibalization is that it increases the wear and tear on the parts in question. Instead of just installing a serviceable part from the supply system onto the aircraft, a maintenance technician must remove a serviceable part from another aircraft and install it on the aircraft in need. Then, when the serviceable part is delivered from the supply system, the technician will then install it on the aircraft from which it was cannibalized. Not only does this dramatically increase the wear and tear on the aircraft parts being cannibalized, cannibalization significantly adds to the manpower requirements needed to bring the fleet to fully mission capable status. With cannibalization actions taking place at both B-52H operational units during each flying day, it is easy to see how the morale of the maintenance technicians could be negatively impacted. "A General Accounting Office study in August found that troops in key specialties cite spare parts shortages and other on-the-job frustrations as the number one reason to leave the military and as veteran technicians quit in disgust, the burden falls ever more heavily on the dwindling number of less-experienced mechanics left behind."[61]

In a review of the Supply Chain Management Assessment during the April 1999 B-52 Weapon System Review, the total mission-capable hours per flying hour status, was highlighted. The following graph illustrates the data presented at that briefing.

Notes

[61] Freedberg Jr., "The Military Scrapes for Spares," 2.



Source: Supply Chain Management Assessment Briefing, B-52 Weapons System Review, 6-7 April 1999.

Figure 1. Total Mission Capable (MICAP) Hours Per Flying Hour.

Figure 1 identifies total mission capable hours per flying hour, the hours per flying hour that the aircraft is awaiting parts that keep it in non-mission capable status, for the period of 1996-1998.[62] For 1996, the average mission capable hours per flying hour were approximately 12.9 hours. For 1997, that rate appears to have jumped significantly to a figure in excess of 28 hours per flying hour. For the final period (1998), the rate again jumps significantly to approximately 47.7 mission capable hours per flying hour.[63] Although numerous factors impact the statistics, apparently the costs increase as the weapon system ages. Interestingly, the top 15 mission-capable supply items drove 42 percent of the B-52H mission capable hours for 1998.[64] For these fifteen items the hours were broken down into four categories. The first category concerned depot constraints,

Notes

[62] Larry Williams, Supply Chain Management Assessment Briefing, B-52 Weapons System Review, 6-7 April 1999, slide 10.
[63] Ibid.
[64] Ibid, slide 11.

amounting to 139,906 hours spanning nine of the fifteen items.[65] The second category was low usage items, which amounted to 14,833 hours concerning two of the fifteen items.[66] The third area was related to contractor repair, amounting to 95,509 hours linked to three of the fifteen items.[67] Finally, a category labeled 'vanishing vendors' was responsible for the largest number of hours, 142,769 hours, linked to only one of the fifteen items that contributed most to the number of mission capable hours per flying hour for 1998.[68] During the April 1999 B-52 Weapon System Review, it was also noted that for 1997, three of the top 15 Mission Capable items were repeat items from 1996 and two of the top 15 mission capable items from 1997 were again repeated in 1998.[69]

The next area of concern pertains to Readiness Support Packages (RSP), tailored B-52 parts/equipment packages designed for mobility usage. During the last major command review there was a dramatic increase in the number of parts required for the RSPs.[70] "During this review, 78 new national stock numbers were added for a total cost of over $108 million. This addition was outside of the Program Objective Memorandum process and funding to support these changes within the execution year is not readily available."[71] As a follow-up, during the October 1999 B-52 Weapon System Review, an RSP support review briefing was provided. This briefing noted that the total number of items for the RSP increased dramatically.[72] This resulted in a 95 percent increase in total

Notes

[65] Ibid.
[66] Ibid.
[67] Ibid.
[68] Ibid.
[69] Ibid, slide 12.
[70] Minutes of the B-52 Weapon System Review, 6-7 April 1999, 5.
[71] Ibid.
[72] Larry Williams, Readiness Spares Package Support Review Brief, B-52 Weapons System Review, October 1999, slide 2.

items and a 50 percent increase in total costs.[73] Next, RSP supportability was identified. The specific item managers evaluated their ability to support the new stock number requirements.[74] The results indicated that eleven percent of the new requirements were unsupportable at that time and RSP growth was a serious concern.[75]

An example of the volatility of maintenance projections and the unique infrastructure problems of aging airframes is the B-52H engine cowlings. During the B-52 Weapon System Review in October 1999, the difficulty in acquiring serviceable engine cowlings was noted. Due to the age of the B-52H fleet, more and more cowlings were being condemned, although history showed only a nine percent overall figure for engine cowlings being condemned or coded "not repairable this station," but that figure had spiked to 22 percent for 1999. During programmed depot maintenance, that number rose again to 31.4 percent of the engine cowlings being condemned or coded "not repairable this station."[76] To make matters worse the existing contractor filed bankruptcy.[77] A new source was required and a new contract was being awarded as of October 1999.[78]

Although the search for spare parts can sometimes appear somewhat bleak, given the age of the airframe and the current cuts in defense spending, the Air Force continues to be proactive in the areas of system and parts acquisition. During the 11 December 1998 Quarterly Acquisition Program Review, the Secretary of the Air Force asked, "Are there any looming subsystem show stoppers that threaten the viability of the aircraft?"[79] This question drove the Air Force Chief of Staff to request the creation of a B-52

Notes

[73] Ibid.
[74] Ibid.
[75] Ibid.
[76] Dawn Champlin, Cowlings Brief, B-52 Weapons System Review, October 1999, slide 3.
[77] Ibid, slide 4.
[78] Ibid.
[79] Larry Williams, Subsystem Support Analysis, B-52 Weapons System Review, 6-7 April 1999, slide 2.

Supportability Roadmap.[80] This Chief of Staff tasker drove a requirement in Air Combat Command for a Weapons System Master Plan and Supportability Roadmap.[81] A team effort involving several levels of the supply system, Headquarters Air Combat Command, and the B-52 System Program Directorate are developing this B-52 Weapon System Master Plan and a Sustainability Roadmap due to the Air Force Chief of Staff by June 2000. Until the results of that study are published, it would be mere conjecture to speculate on the future of B-52H parts sustainability.

Current and Future Threat

The threat environment shapes how we define our capabilities and achieve success.[82] Current national security objectives require the Air Force to project military power at any location on the globe and sometimes on very short notice.[83] These requirements can range from low-intensity conflict at one end of the combat spectrum to major theater war at the other. The long range capability of today's bomber fleet could make them first on the scene in a crisis, in locations where the United States may not maintain forces.[84]

> In the future, our long-range airpower may initially find itself in environments with limited support packaging and battlespace awareness. In this environment the bomber force may encounter advanced Surface to Air Missiles and fourth generation fighters. Survival requires the ability to data-link fused Intelligence, Surveillance, Reconnaissance information to either avoid the threat or use countermeasures or stealth to reduce risk. Weapon's effectiveness will depend on the bomber's ability to locate and identify mobile targets, rapidly mission plan and re-program weapons in flight, and employ weapons outside lethal threat envelopes. These capabilities require exploiting off-board sensors (data-fused and data-

Notes

[80] Ibid.
[81] Ibid.
[82] U.S. Air Force White Paper on Long Range Bombers, March 1999, 13.
[83] Ibid.
[84] Ibid.

linked to the bombers) and improving bomber radars to identify and track mobile targets.[85]

To properly analyze the B-52H's current level of survivability and effectiveness, and to predict the level it may have in the future, we first need to look at the current and projected capabilities and missions of the B-52 weapon system and then see how they may match up against current and expected future threats. Currently the B-52H is earmarked to fulfill two main roles. The first role is to serve as a standoff weapons carrier.[86] Conventional cruise missiles strike fixed targets in defended areas from a standoff position to compensate for the B-52H's slower speed and larger radar cross section.[87] The B-52H's second role is to deliver massive firepower in areas of low threat.[88] As demonstrated in Desert Storm, the B-52H's ability to drop 38,000 pounds of unguided bombs on targets in areas under allied air superiority will continue to be a useful and demoralizing capability.[89] The addition of current and future programmed precision guided munitions will only increase the B-52H's ability to unleash firepower in low threat areas. The bottom line is that the B-52H will have to remain survivable, using the standoff mode and updated electronic warfare equipment, and effective, via weapons modernization programs.

As the United State's permanent overseas military presence drastically declines, the Aerospace Expeditionary Forces will be tasked to pick up the slack. The B-52H and other long-range bombers combine with strike, air superiority and support aircraft, to create a synergistic effect that is key to the lean, tailored, lethal, and responsive

Notes

[85] Ibid, 14.
[86] Department of the Air Force, Enhancing the Nation's Conventional Bomber Force: The Bomber Roadmap, June 1992, 8.
[87] Ibid.
[88] Ibid.
[89] Ibid.

Aerospace Expeditionary Force.[90] The B-52 appears to fulfill both the primary and secondary roles identified in The Bomber Roadmap, dated June 1992. It still functions as a stand-off weapons carrier and is still able to deliver massive firepower in a low-threat environment. In addition, the B-52 carries the most diverse payload of all the bombers in the United States fleet.[91] The B-52H is the only bomber in the bomber fleet to carry the AGM-86/B Air Launched Cruise Missile, the AGM-86/C Conventional Air Launched Cruise Missile, the AGM-129/A Advanced Cruise Missile and the AGM-142 Have Nap Missile.[92]

During operations in Kosovo, the B-52 was the first to strike, beginning the air campaign with Conventional Air Launched Cruise Missile strikes. The B-52s flew 26 sorties, launching 78 missiles and struck 75 targets.[93] In addition, the B-52Hs executed 34 days of bombing over Kosovo. A total of 161 combat sorties were flown, dropping a total of 6,370 general purpose bombs.[94] Throughout the Kosovo campaign, the B-52Hs maintained a 98 percent combat mission capable rate.[95] Again demonstrating its versatility, the B-52 bomber conducted Psychological Operations, Standoff Jamming and Humanitarian Operations.[96]

Although the B-52H continues to be called upon in support of United States military action around the globe, its ability to provide standoff and direct attack in air superiority environments depends on maintaining its Situational Awareness and Electronic Attack by upgrading its Electronic Combat Suite. A recent Supportability Assessment of the B-52's

Notes

[90] Ibid, 15.
[91] Ibid, 18.
[92] Ibid, 11.
[93] Quarterly Acquisition Program Review: B-52, December 1999, Version: 11th Draft 18 November 1999, slide 3.
[94] Ibid.
[95] Ibid.

Electronic Combat Suite was less than favorable.[97] This assessment noted that Electronic Combat Suite reliability was decreasing, maintenance actions were increasing and system effectiveness was also decreasing.[98] The Electronic Combat Suite Supportability Assessment also noted that by 2005, the B-52 would begin losing today's level of Situational Awareness and Electronic Attack unless specific actions were taken to improve the system.[99] If no actions were taken the B-52 would see marked degradation in Situational Awareness and Electronic Attack after 2010.[100] According to the *U.S. Air Force White Paper on Long Range Bombers* dated 1 March 1999, "Situational Awareness is the highest priority modification needed for the B-52."[101] Situational Awareness upgrades will allow the B-52H to continue to launch cruise missiles outside of threat ranges, as well as, to employ shorter range missiles and direct attack munitions in air superiority environments.[102] "Adequate situational awareness will be maintained via upgrade of critical navigation systems and onboard sensors and through incorporation of information from off-board sources."[103]

Today's electronic combat suite is an "aging, federated system of systems with many line replaceable units facing obsolescence and vanishing vendors."[104] The B-52H electronic combat system is an average of 38 years old with 46-50 percent of the system's

Notes

[96] Ibid.
[97] Jim McGinley, B-52 Electronic Combat Suite Supportability Assessment Brief, B-52 Weapons System Review, October 1999, slide 3
[98] Ibid.
[99] Ibid.
[100] Ibid.
[101] U.S. Air Force White Paper on Long Range Bombers, March 1999, 7.
[102] Ibid, 18.
[103] Ibid.
[104] Jim McGinley, B-52 Electronic Combat Suite Supportability Assessment Brief, B-52 Weapons System Review, October 1999, slide 14.

parts currently without a qualified manufacturing source.[105] The impact of defraying the investment is, of course, that the electronic suite readiness will decline in the areas of reliability and maintainability and the effectiveness against the evolving threat is questionable.[106]

The September 1999 B-52 Electronic Combat Suite Supportability Assessment identified the following required actions. The assessment highlighted that the Situational Awareness Defensive Improvement Program must be fully supported in order to prevent ALR-20, Panoramic Receiver System, failure in 2005.[107] This failure would result in a loss of lower situational awareness utilized for the stand-off role and a loss of lower electronic attack visibility.[108] In addition, the assessment noted that the Electronic Counter-measure Improvement Program should be fully supported to eliminate the ALQ-172, Electronic Counter-Measure System being unsupportable for reprogramming in 2001.[109] This support would also prevent the loss of higher situational awareness and higher electronic attack, as well as, the complete line replaceable unit unsupportability falling somewhere around the 2010 timeframe.[110]

The B-52H Modernization Program addresses the potential survivability, situational awareness and employment problems by highlighting survivability, reliability and maintainability. The B-52 Modernization Program is broken down into four parts. The first part, concerning Advanced Weapons Integration, is made up of the Avionics Mid-life Improvement; Advanced Weapons: Joint Direct Attack Munitions, Joint Standoff

Notes

[105] Ibid, slide 27.
[106] Ibid, slide 33.
[107] Ibid, slide 52.
[108] Ibid.
[109] Ibid.
[110] Ibid, slide 22.

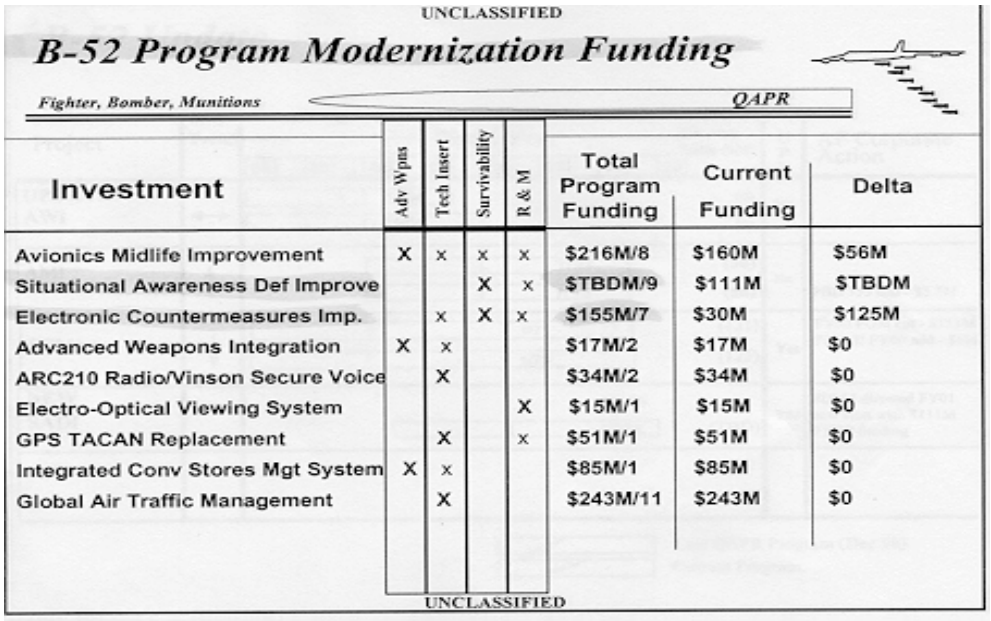
Weapon, Wind Corrected Munitions Dispenser, Joint Air to Surface Standoff Missile; and the Integrated Conventional Stores Management System.[111] The second part of the B-52 Modernization Program concerns technology insertion. It is made up of the Global Positioning System/TACAN, ARC-210/VINSON and the Global Air Traffic Management System.[112] The third part of the program is concerned with survivability and is made of the Electronic Countermeasures Improvement and the Situational Awareness Defensive Improvement Programs.[113] The final part of the program concerns reliability and maintainability and is made up of the Electro-optical Viewing System.[114]

Tables one and two depict the B-52 Modernization Program funded and unfunded system status as of December 1999 at the Quarterly Acquisition Program Review for the B-52.[115]

Notes

[111] Quarterly Acquisition Program Review: B-52, December 1999, Version: 11th Draft 18 November 1999, slide 4.
[112] Ibid.
[113] Ibid.
[114] Ibid.
[115] Ibid, slides 5-6.

Table 1. B-52 Program Modernization Funding as of December 1999



UNCLASSIFIED

B-52 Program Modernization Funding

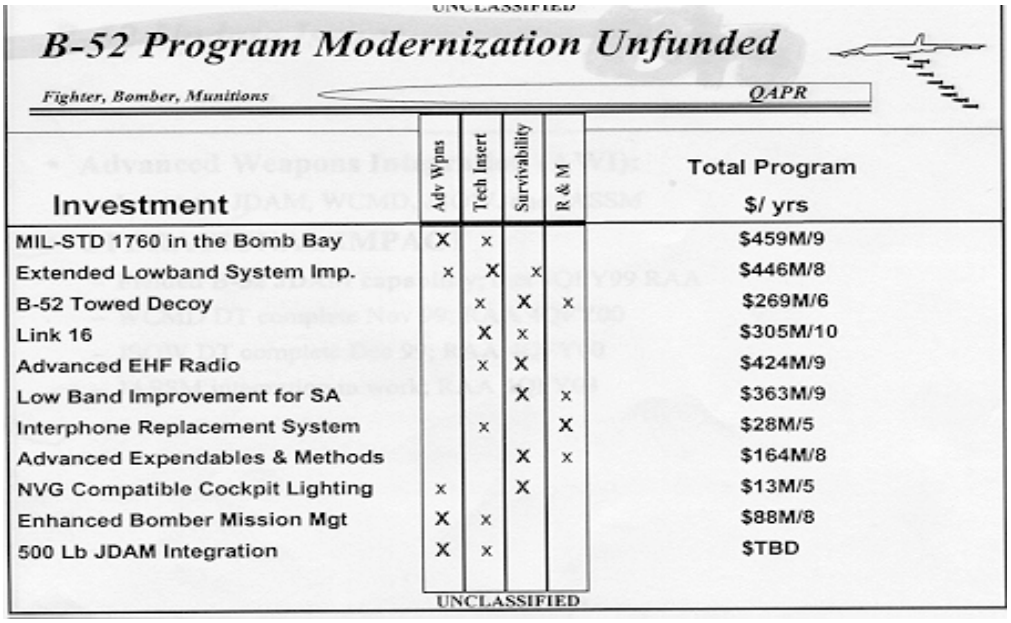
Fighter, Bomber, Munitions — QAPR

Investment	Adv Wpns	Tech Insert	Survivability	R & M	Total Program Funding	Current Funding	Delta
Avionics Midlife Improvement	X	x	x	x	$216M/8	$160M	$56M
Situational Awareness Def Improve			X	x	$TBDM/9	$111M	$TBDM
Electronic Countermeasures Imp.		x	X	x	$155M/7	$30M	$125M
Advanced Weapons Integration	X	x			$17M/2	$17M	$0
ARC210 Radio/Vinson Secure Voice		X			$34M/2	$34M	$0
Electro-Optical Viewing System				X	$15M/1	$15M	$0
GPS TACAN Replacement		X		x	$51M/1	$51M	$0
Integrated Conv Stores Mgt System	X	x			$85M/1	$85M	$0
Global Air Traffic Management		X			$243M/11	$243M	$0

UNCLASSIFIED

(Source: B-52 Quarterly Acquisition Program Review, December 1999)

Table 2. B-52 Program Modernization Unfunded Requirements as of December 1999



UNCLASSIFIED

B-52 Program Modernization Unfunded

Fighter, Bomber, Munitions — QAPR

Investment	Adv Wpns	Tech Insert	Survivability	R & M	Total Program $/ yrs
MIL-STD 1760 in the Bomb Bay	X	x			$459M/9
Extended Lowband System Imp.	x	X	x		$446M/8
B-52 Towed Decoy		x	X	x	$269M/6
Link 16		X	x		$305M/10
Advanced EHF Radio		x	X		$424M/9
Low Band Improvement for SA			X	x	$363M/9
Interphone Replacement System		x		X	$28M/5
Advanced Expendables & Methods			X	x	$164M/8
NVG Compatible Cockpit Lighting	x		X		$13M/5
Enhanced Bomber Mission Mgt	X	x			$88M/8
500 Lb JDAM Integration	X	x			$TBD

UNCLASSIFIED

(Source: B-52 Quarterly Acquisition Program Review, December 1999)

Now let's identify the future capabilities that these systems will provide the B-52H and its crew members. The Advanced Weapons Integration Program integrates the Joint Direct Attack Munitions, Wind Corrected Munitions Dispenser, Joint Standoff Weapon, and the Joint Air to Surface Standoff Missile.[116] This system will improve combat capability with precision and near-precision bombing at medium and high altitude.[117] With a system load-out of 12-Joint Direct Attack Munitions, 16-Wind Corrected Munitions Dispensers, 12-Joint Standoff Weapons and 12-Joint Air to Surface Standoff Missiles, this system will act as a force multiplier, enabling the B-52 to strike multiple targets per bombing run.[118]

The Avionics Mid-life Improvement Program will replace the Inertial Navigation System, Avionics Computer, and Data Transfer System, thereby upgrading the B-52 Offensive Avionics System, improving navigation and weapons delivery.[119] The addition of this system will eliminate the loss of combat capability beginning in 2006, preserving B-52 weapons delivery, navigation capability and enabling growth for future requirements.[120] In addition, the Avionics Mid-life Improvement Program will reduce operational and maintenance costs, as well as, increase memory and processing speed of the system.[121]

The Electronic Countermeasures Improvement Program, which has been identified as Air Combat Command's number one B-52 priority, will increase Electronic Combat

Notes

[116] Ibid, slide 29.
[117] Ibid.
[118] Ibid.
[119] Ibid, slide 9 and 23.
[120] Ibid, slide 9.
[121] Ibid, slide 9 and 23.

Suite reliability, reduce operational and maintenance costs, add flightline and in-flight re-programmability, as well as, improve electronic warfare situational awareness.[122]

While the B-52's current system is projected to begin failing in 2003, losing its primary means of situational awareness, the Situational Awareness Defensive Improvement Program will restore the early warning and combat situational awareness, increasing reliability and reducing operational and support costs.[123]

The guidance in the *Electronic Warfare Roadmap* dated 6 June 1999 is clear, "The B-52 has been the nation's primary bomber for over 40 years. This high visibility platform supports a full range of nuclear and conventional combat missions and requires adequate defensive systems. This aircraft is absolutely essential to support the Air Force's core competency of power projection."[124] The *Electronic Warfare Roadmap* assumes that the Electronic Countermeasure Improvement Program will be funded for the entire fleet, again, since this is the highest priority electronic warfare program identified for the B-52.[125] In addition, the "Roadmap" assumes that the B-52 will continue to need on-board electronic countermeasures and situational awareness for both direct attack and standoff missions.[126] Finally, the "Roadmap" assumes that future data links will provide Beyond Line of Sight and in theater enhancements, providing real-time intelligence in the cockpit, building long-range situational awareness, minimizing and avoiding threats undetectable/uncountered by onboard systems.[127] In summary, the *Electronic Warfare*

Notes

[122] Ibid, slide 10 and 21.
[123] Ibid, slide 11.
[124] AF/XO, Electronic Warfare Roadmap, 6 June 1999, paragraph 5.2.2.5 (U).
[125] Ibid.
[126] Ibid.
[127] Ibid, paragraph 5-26 (U).

Roadmap appears to echo the information presented in the December 1999 Quarterly Acquisition Program Review. The "Roadmap" states,

In view of the B-52 as the only Air Force platform with standoff capability, there needs to be a commitment to upgrade/replace this aircraft's electronic warfare system. Currently Electronic Counter Measures Improvement Program is funded only in FY00. Situational Awareness Defensive Improvement Program is unfunded. Without this minimum electronic warfare capability, the B-52 will not be able to conduct this mission.[128]

Notes

[128] Ibid, paragraph 5-29 (U).

CHAPTER 3

CONCLUSIONS AND IMPLICATIONS

> *For want of a nail, the shoe was lost – for want of a shoe, the horse was lost – for want of a horse the rider was lost – for want of a rider the battle was lost.*
>
> Benjamin Franklin

To determine whether the B-52H could survive as an effective strategic bomber until the projected 2050 phase out, this paper was divided into three major sections that addressed two central sub-questions. The first of these was, "Can the B-52H fly until the final airframe is phased out in 2050?" The second sub-question was, "Can the B-52H remain effective until the scheduled phase-out?"

The first section provided the reader with a foundation by highlighting the extensive B-52H history of aircraft modifications and mission changes. What conclusions can we draw from the history of the B-52H? Given its past versatility and adaptability, coupled with the future missions programmed for the B-52H, this bomber can be relied upon to maintain the same degree of versatility and adaptability it has demonstrated throughout its long and distinguished history. Through numerous modifications and various armament configurations, the B-52H has displayed a level of flexibility rarely seen throughout the history of airpower. The B-52H continues to evolve from its original mission as a low-level nuclear penetrator, to encompass both high and low altitude conventional missions, to its current role as a stand-off conventional bomber and direct

attack profile bomber in environments with air superiority. Continued evolution of the B-52H will encompass a stand-off or direct attack conventional mission coupled with a follow-on stand-off jammer capability to supplement the EA-6B Prowler. Most significantly, the B-52H is the only bomber in the fleet to carry the AGM-86/B Air Launched Cruise Missile, the AGM-86/C Conventional Air Launched Cruise Missile, the AGM-129/A Advanced Cruise Missile and the AGM-142 HAVE NAP missile. Recent air operations in Bosnia, Afghanistan and Kosovo illustrate that the United States must maintain these capabilities.

After reviewing the B-52H's extensive history of aircraft modifications and mission changes, the next logical step was to review the current concerns surrounding the dramatic extension to its service life. Sections one and two, concerning B-52H structural integrity and spare parts availability, relate directly to the first sub-question discussed in the introduction, "Can the B-52H fly until the final airframe is phased out in 2050?" A discussion of B-52H structural integrity and review of service life data as it pertained to the Air Force Structural Integrity Program identified current and future plans for structural modernization of the B-52H. The Air Force appears to be taking full advantage of life cycle wear and tear information available from previous B-52 models to better maintain the B-52H fleet. Again, that analysis provides valuable data in maintaining the current B-52H inventory. The updated Durability and Damage Tolerance Assessment; incorporating the effects of tactical maneuver and extended usage up through calendar year 2030, combined with safety, inspection and repair data, was key to the current cost-effective structural maintenance plan. This well-managed B-52 Structural Integrity Program, with the future addition of the standard Flight Data Recorder appears to be the

necessary insurance the Air Force needs to be able to fly the B-52H until 2030 applying the Durability and Damage Tolerance Assessment "worst case scenario." This criteria, coupled with the limiting factor of the B-52H economic limit of the upper wing surface, addresses the feasibility of the B-52H to fly to 2030 and beyond, but fails to address with any certainty this paper's first sub-question, related to the B-52H's ability to fly until the final aircraft is phased out in 2050. In addition, increased corrosion due to a number of factors including increased flight time in corrosive environments, as well as, operational life limit adjustments due to future modifications to wing loading profiles will decrease the structural life and increase the structural maintenance on the B-52H fleet.

Next, a discussion of the acquisition of spare parts and related serviceability issues highlighted the limited supply and condition of numerous spares from the B-52 “bone-yard” and current “mom and pop vendors” in an attempt to again answer the first sub-question discussed in the introduction, "Can the B-52H fly until the final airframe is phased out in 2050?" The first issue discussed, which continues to be a problem, is the receipt of unserviceable parts from AMARC. Again, although this problem could have a long-term impact on the mission capable rate of the B-52H fleet, the Air Force is investigating the feasibility of inspecting parts removed from the AMARC prior to receipt by field units.[129] Secondly, the author discussed morale problems identified in a General Accounting Office study resulting from increasing B-52H parts cannibalization rates, a by-product of parts delays and the receipt of unserviceable parts. If unresolved, this continuing trend in cannibalization rates will lead to increases in wear and tear on the airframe and decreases in the retention of experienced technicians, which may eventually lead to an increase in the B-52H accident rate. Finally, we discussed the April 1999

Supply Chain Management Assessment, which highlighted a significant increase in 'Total Mission Capable Hours per Flying Hour' from 1996-1998 because of a lack of spare parts due to vendor availability and long-term usage.

In conclusion, what implications can be drawn from the past and current spare parts challenges? As one would expect, as the system ages the associated costs increase. This author envisions a continued shrinkage of the spare parts pool, which will continue to have negative impact on the fully mission capable rate of the B-52H fleet. This degradation of the fully mission capable rate will further impact operational life limits in the B-52H structural integrity arena due to greater-than-predicted flying hours on the remaining serviceable airframes. The Air Force will be flying less aircraft more hours, which will increase structural problems and the associated maintenance requirements. In addition, any increased frequency of conflicts requiring the services of the B-52H fleet would accelerate the airframe life cycle, negatively impacting the structural life and increasing the requirement for spare parts. Furthermore, with the shrinking parts pool discussed earlier, this author believes that the cannibalization rate for spare parts will continue to increase, exacerbating the wear and tear on associated parts and the airframes themselves, as well as, leading to a continued decrease in the retention of experienced technicians. As a final note, the author applauds the Air Force's proactive approach to addressing system and parts acquisition, but believes that the real answer to the parts debate will not be fully realized until the B-52H Weapon System Master Plan and the Sustainability Roadmap are published later this year. Until the results of those studies are known, it would be mere conjecture to speculate on the future of B-52H parts

Notes

[129] Minutes of the B-52 Weapon System Review, 6-7 April 1999, 4.

sustainability and their impact on the B-52H's ability to fly until the final airframe is phased out in 2050.

Finally, a general discussion of current and projected capabilities and comparison to the best estimates of future threats attempted to answer the second sub-question identified in the introduction, "Can the B-52H remain effective until the scheduled phase-out?" Although the B-52H continues to be called upon in support of United States military action around the globe, its ability to fulfill its functions of standoff and direct attack in air superiority environments depends on maintaining its Situational Awareness and Electronic Attack by upgrading its Electronic Combat Suite. The impact of defraying the investment is, of course, that the Electronic Suite Readiness will decline in the areas of reliability and maintainability and the effectiveness against the evolving threat is questionable. The bottom line is that the B-52H will have to remain survivable, using the stand-off mode and updated electronic warfare equipment, and effective, via the Weapons Modernization Program.

In conclusion, to attempt to guarantee the effectiveness of the B-52H until the scheduled phase-out, answering our second sub-question, this author recommends funding the B-52H Modernization Program in its entirety. This would provide the B-52H fleet with the Advanced Weapons Integration, made up of the Avionics Mid-life Improvement; Advanced Weapons: Joint Direct Attack Munitions, Joint Stand-off Weapon, Wind Corrected Munitions, Joint Air to Surface Stand-off Missile; and the Integrated Stores Management System providing the B-52H improved combat capability with precision and near-precision bombing at medium and high altitude. Secondly, the Modernization Program would provide the B-52H with the Global Positioning

System/TACAN, ARC-210/VINSON, and the Global Air Traffic Management System to improve navigation and weapons delivery. The third part of this program is concerned with survivability and is made up of the Electronic Countermeasures Improvement and the Situational Awareness Defensive Improvement Programs reducing operational and maintenance costs, adding flightline and in-flight reprogramability, improving electronic combat situational awareness, and restoring the Early Warning and Combat Situational Awareness. The final part of the Modernization Program concerns reliability and maintainability and is made up of the Electro-optical Viewing System.

In summary, to answer the question, "Can the B-52H survive as an effective strategic bomber until the projected 2050 phase-out?", it is the opinion of this author that although the B-52H has demonstrated the versatility and adaptability required to see it through an additional fifty years of service, numerous other factors question its survival as an effective strategic bomber until the projected 2050 phase-out.

Concerning structural integrity, the current Durability and Damage Tolerance Assessment criteria coupled with the economic limit of the upper wing surface, failed to address with any certainty the B-52H's ability to fly until the final aircraft is phased out in 2050. In addition, increased corrosion and wing loading profiles will decrease the structural life of the B-52H fleet.

Next, considering past and present spare parts challenges, the predicted continued shrinkage of the spare parts pool will ultimately impact operational life limits in the B-52H structural integrity arena. In addition, any increased frequency of conflicts would negatively impact the structural life and increase the requirement for spare parts. Furthermore, the shrinking parts pool will increase the cannibalization rate, exacerbating

wear and tear on associated parts and airframes. Finally, until the results of the B-52H Weapons System Master Plan and the Sustainability Roadmap are known, B-52H parts sustainability and their impact on the B-52H's ability to fly until 2050 remain unknown.

Concerning the B-52H's ability to remain effective against future threats, this author views the funding of the B-52H Modernization Program in its entirety, as the initial step in attempting to guarantee the effectiveness of the B-52H until the scheduled phase-out in 2050.

Consequently, without additional evidence to support further extensions in service life resulting from additional Structural Integrity Program studies, the B-52H Weapons System Master Plan, the Sustainability Roadmap, and from longer-term studies on future threats, this author does not support a B-52H bomber phase-out beyond 2030.

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